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PATENT SPECIFICATION

581,121

Convention Date (United States of America) : Nov. 9, 1940.

Application Date (in United Kingdom) : Feb. 12, 1941. *No. 1916/41.*

Complete Specification Accepted : Oct. 2, 1946.

(Under Section 91, sub-sections (2) and (4) of the Patents and Designs Acts, 1907 to 1942, a Single Complete Specification was left in respect of this Application and of Applications No. 1914/41 and 1915/41, and was laid open to inspection on Aug. 11, 1941).

COMPLETE SPECIFICATION

Refrigerator

I, GUYON LOCKE CROCHERON EARLE, a Citizen of the United States of America, of 37, Greenway, South, Forest Hills, New York, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This application relates to kitchen devices and more specifically to mechanical refrigerators.

It is an object of this invention to provide a novel mechanical refrigerator.

The usual mechanical refrigerator has a box-shaped inner compartment for the refrigeration of food. Within this compartment is a cooling coil surrounding two, three, four or more ice cube trays. In refrigerators of comfortable capacity, the cooling coil does not usually take up all the room available from the back of the cooling compartment to the front and the space left either in front of or in back of the coil is wasted as far as use is concerned and it is an object of this invention to obviate this drawback.

It is another object of this invention to provide an upper shallow refrigerated compartment and a lower deep refrigerated compartment together with means for ensuring circulation of refrigerated air therebetween and more specifically to provide means for ensuring a " double " circulation of cold air, the first circulation being that (relatively rapid) in the rear of the refrigerator and the second circulation being a slower circulation in the front portion of the refrigerator. With these objects in view the present invention comprises a mechanical refrigerator consisting of walls forming an enclosure and including upper and lower portions, the upper portion of the refrigerator having a front surface which is set-back and is substantially parallel to the front surface of the lower portion thereof, an evaporator in said upper portion, a table-top member above the lower portion and in front of the upper portion, and a plurality of drawers arranged one above another in said lower portion and opening from the front of the refrigerator, said drawers having a length such that when they are in the closed position there is an open space at the rear thereof in which space there is a relatively rapid circulation of cold air which flows in a current from the evaporator downwardly and then upwardly in the rear part of the lower portion, and at least one of said drawers under the top one having a member (such as the bottom of the drawer or a rack or tray carried by the drawer frame), a major portion, at least, of which is impervious, extending in a substantially horizontal direction from the front part of the lower portion of the refrigerator into the cold air current at the rear thereof by an amount sufficient to deflect cold air from said current toward the front part of said lower portion of the refrigerator but not sufficient to cut off said current, whereby there is produced a generally horizontal, slower moving air current in said drawer in addition to the cold air current in the rear part of said lower portion.

The use of drawers is advantageous as it permits more food to be accessibly stored and makes it possible to better arrange the food in the refrigerator and to take out an article without disarranging other dishes or packages, etc. The housewife needs only to pull out a drawer and then place the article to be refrigerated exactly where she wants it, or take out an article, both without moving the adjacent food. Moreover, she can easily see exactly what is in the refrigerator without stooping or without squinting around articles placed at the

Price 33p

front of the refrigerator (as in the case of the conventional single door refrigerator).

In the usual box-type refrigerator, the circulation of cold air is from the bottom of the evaporator, down one side to the bottom of the refrigerator, across the bottom surface, and then up the other side to the evaporator where it strikes the top and side thereof. If this circulation only were provided for the setback refrigerator, not sufficient cold air would reach the front part of the refrigerator (where it is needed most), as the evaporator is located at the rear portion of the refrigerator and the cold air circulation would tend to take place only in the rear of the refrigerator leaving a warm spot in the front. The deflecting means provided in accordance with the present invention circulate some of the cold air into the front portion of the lower part of the refrigerator. With a drawered structure difficulty has been encountered in obtaining adequate cold air circulation, especially in the lower drawers. The circulation is improved in accordance with this invention, by providing one or more apertures in the bottoms of each of the upper ones of the drawers (and possibly also in the lower drawer). The lower drawers can be made longer than the top one or ones to permit a portion of the cold air to be deflected into the top drawer and allow other portions to be guided into the rear portions of the lower drawers, although this is not necessary as all of them can be of the same length, there being left sufficient space between the drawers for the cold air to get into each drawer from the rear. For this purpose a comparatively clear space is provided for rapid circulation of cold air in the rear of the drawers. One or more of the drawers may have a lip at the rear thereof to help guide cold air into the drawer, or it may have a sloping rear portion.

In the arrangement according to this invention, it can be considered that there is a " double " circulation of cold air, (1) the conventional one where the cold air goes downward in substantial vertical paths from the evaporator, across the bottom of the refrigerator and then up the other side thereof to the top and side of the evaporator, and (2) that caused by the circulation of air in a generally horizontal direction through at least one of the drawers and more especially the top drawer which can be aided by providing this drawer with a sheet bottom with a slot across or a hole in the front portion thereof so that the cold air is carried largely to the extreme front of the upper drawer before passing down to a lower drawer. By actual test this " double " circulation has been found to be very effective in providing an even degree of cold in the refrigerator and it is even possible to make the front part of the refrigerator as cold as the upper rear. It has been discovered by these tests that if this rear circulation is interrupted or cut off, the temperature of the box mounts seriously showing that the rear circulation makes the set-back refrigerator with drawers efficient. If the cold air is not deflected forward there would be a cold and rapid circulation at the rear but the upper front portion is many degrees warmer than the rear. Likewise unless the rear is left so that there may be a circulation (by the drawers not projecting to the rear wall or there being open spaces in the rear of the drawers to allow the rear circulation) and part of the cold air deflected forward, portions of the refrigerator box would have a great difference of temperature between them with the result that the preserving of food would be jeopardized. In any set-back refrigerator, the double circulation and the deflecting means are essential for the best results.

In one embodiment of this invention, chosen by way of example for illustrative purposes, a refrigerator is provided comprising a relatively deep (considering depth as the horizontal dimension from front to rear) lower portion, a relatively shallow upper portion the front of which is set back from the front of the lower portion, and a table top member above the lower portion and in front of the upper portion. The lower portion comprises a plurality of drawers, the lower one being higher than the others. In the upper portion of the refrigerator is arranged the evaporator unit, ice cube trays, and an upper refrigerated compartment. Above the refrigerator is preferably placed a suitable cabinet structure, the front plane of which is preferably set out from the front plane of the upper portion of the refrigerator but which is set back from the front plane of the lower portion of the refrigerator. The compressor for the refrigerator may be located under a sink or other unit adapted to be placed adjacent the refrigerator unit and connection is made to it from the evaporator by means of flexible tubing. All drawer fronts, doors, and walls are thickly insulated and all drawer and door seats are gasketed. Contact between the inside and the outside walls of the refrigerator is broken by suitable means.

Deflecting means (either one or more angularly arranged plates and/or angularly biased connecting strips between the

upper and the lower portions of the refrigerator) for partly deflecting the cold air from the evaporator in the upper portion on its way to the lower portion, causes the cold air to " spill " over the rear part of the upper storage space. The deflecting means is arranged to permit some of the air to pass down through the rear of the refrigerator while deflecting the rest of the air from the evaporator in such a manner that it is deflected toward the front of the refrigerator. Means may be provided under the deflecting means to catch the drip water of defrosting and to deflect the cold air.

The invention will be more readily understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof, in which:—

Fig. 1 is a perspective view of a refrigerator in accordance with this invention;

Fig. 2 is a side elevation view in partial cross-section of the refrigerator of Fig. 1 with the drawers closed;

Fig. 3 is a front view of a deflecting member used in the structure shown in Fig. 2;

Fig. 4 is a side view of the deflecting members of Fig. 3 and a gutter member used as a guide for water droplets produced in defrosting; and

Fig. 5 is a front elevation view of the refrigerator of Fig. 1 with arrows superimposed to indicate air circulation within and dotted portions indicating the positions of the evaporator and one of the deflecting members.

Referring more particularly to the drawings, there is shown in Fig. 1 for purposes of illustration to point out certain features of novelty of this invention, a refrigerator 10 which will be hereinafter designated a " set-back " refrigerator because the front surface of the upper portion 13 thereof is set-back from the front surface of the lower portion 12 thereof and which may be constructed in accordance with the invention of co-pending application No. 1915/41, (Serial No. 579,071). This co-pending application describes and claims a mechanical refrigerator including a relatively deep lower portion having an opening in the upper part thereof, a relatively narrow upper portion having an opening in the lower part thereof of substantially the same size as and coinciding with the opening in said lower portion, and a sealed refrigerating unit including an evaporator unit, a liquefying unit and tubes for the flow of refrigerant between these units, said evaporator unit being secured within said upper portion and said liquefying unit being positioned outside of both said portions said tubes passing out of the assembled upper and lower portions at the junction therebetween.

The refrigerator 10 rests on a base member 11 which is set-in to provide toe room for the user. Above the upper portion 13 may be placed, if desired, a cabinet section 14. A table top member 15 covers that portion of the lower refrigerated portion 12 which is in front of the upper portion 13. The refrigerator 10 is particularly adapted to be used in a kitchen unit which also includes a stove, a sink and a dish drainer and cabinets, the table top member serving as a drain board for the sink.

The lower portion 12 of the refrigerator comprises side walls 16 and 17, a back wall 18, and a front wall 19 which is broken up to provide mullions 20 for a plurality of drawers 21, 22, 23 and 24, the lower one of which can be higher and deeper than the others so as to accommodate a large number of bottles, a large roast, etc. The upper portion 13 of the refrigerator comprises an evaporator compartment 25 and an upper refrigerator compartment 26 at the side thereof. The compartments 25 and 26 are closed by doors 27 and 28 respectively.

The upper portion 13 of the refrigerator has side walls 29 and 30 which may be the upper portions of the side walls 16 and 17, if desired, but preferably the upper and lower portions of the refrigerator are made as separate entities and connected together in the kitchen by means of a suitable gasket 31, the connections or pipes 32 from the evaporator coils 33 preferably passing out the side of the refrigerator through the gasket, although in some arrangements these connections may pass out to the rear of the refrigerator or through a hole in the wall of the refrigerator cabinet. The compressor of the refrigerator is preferably located under the sink if the refrigerator of this invention is part of a kitchen unit including a sink adjacent the refrigerator.

Located within the evaporator coils 33 are a plurality of ice cube trays 34 to 36 inclusive, the lower tray 36 preferably being larger than the others. The evaporator is placed snugly within the frame to eliminate the necessity for an inner door but with enough space to prevent the door 27 from being frozen shut. There is preferably space at the side and back for better circulation of cold air around the evaporator and through the ice tray compartments. If desired the tray 36 may be used as a means to freeze food, the grid member for the ice cubes

being removed for this purpose. Or, if desired, the tray 36 may be removed entirely and replaced by a drawer front or even a door. As another alternative a frozen food compartment (not shown) may be located under the drawer 36 (assuming the upper portion has sufficient height for the purpose) the food to be super-cooled being placed on a shelf (not shown) beneath the evaporator coils 33. Also beneath the coils 33 may be removably arranged one or more substantially planar deflecting members 40 which may be used to " spill " part of the cold air from the evaporator 33 into the top drawer and thence to the upper front and middle front portions of the refrigerator. Some of the cold air passes through the space between the deflecting members 40 to reach the lower rear portion of the refrigerator. The front portion of the refrigerator really needs more cold air than the rear because the circulation is slower and the rear is built-in and not so exposed to room temperature, but a more rapid circulation necessary for the efficiency of the evaporator is caused to take place in the rear—behind or through the open rear portions of the drawers. One or more layers of insulation in the walls of the back of the refrigerator and for the drawer fronts may be provided and similar layers of insulation (not shown) provided for the sides, top and bottom.

The angularly arranged connecting strips 38 and 39 between the upper and lower portions of the refrigerator, in co-operation with the deflecting members 40, " spill " the cold air into the drawer 21 and also into the container 41 which may be double-walled or otherwise insulated and which may be mounted in or carried by the top drawer. The member 41 serves as an extra cold food container and also can be used to catch the drip from the evaporator when the refrigerator is being defrosted. In defrosting (and at other times also, if desired), the deflecting members 40 (see Figs. 2 and 4) may be used to guide the drip water. The turned-up ends 112 of the deflecting members 40 catch the water of defrosting and direct this drip water from the evaporator coils 33 away from the air circulation spaces 114 between the members 40 and into a gutter (or gutters) 113 which lead into the container 41. The members 40 can be so spaced that every drop of water of defrosting strikes one of the deflecting members 40. The container 41 can be slidably mounted so that it may be moved under the deflector drip or out in the front of the drawer 21, as desired. One slotted or apertured deflecting member 40 can be provided and arranged so that when not defrosting it may be removed or not, as desired. The water of defrosting passes through the slots or apertures into the container 41. The container 41 can have a cover 44 which is preferably lower at the front than the back so that it can act as part of the deflecting means to carry the cold to the front of the refrigerator. The top 44 of the container 41 can be attached above or it may rest on the container 41. In either event provisions can be made for making slidable adjustment between the top 44 and the container 41 so that more or less of the rear portion of the container 41 can be left partly open at the top to allow the cold air from the evaporator to " spill " into the container 41 or it can be completely closed or opened. If desired, the rear part of the upper refrigerated portion 13 can overhang the rear part of the lower refrigerated portion 12 and can project into the wall 120 of the room, as in the arrangement shown in Fig. 2.

Above the upper refrigerated portion 13 of the refrigerator there is provided a cabinet member 14 equipped with a number of shelves 50 and closed by doors 51 and 52. A molding or boxed-down ceiling 53 is located above the cabinet section.

Referring now to the lower portion of the refrigerator, each of the drawers or frames 21, 22, 23 and 24 can be supported from its well by telescopic extension members 60. In one arrangement, all of the drawers are of substantially the same length and are either shorter than the well to permit an air circulation behind them or else are of full length with openings in the rear thereof to permit the circulation of cold air therethrough. In another arrangement, the top drawer is made shortest and the lower ones increase progressively in length, the bottom drawer being longest. In another arrangement, all drawers except the bottom one are of the same length and are shorter than the depth of the well. This latter arrangement is shown merely by way of example in the drawings. Each drawer, for example, comprises a drawer frame 61 on the front portion of which is attached a drawer front and on the rear portion of which is attached a bumper 63 which is part of an air cushion arrangement 64 for checking the inward movement of the heavily laden drawer. Rollers 65 (preferably two per drawer) engage tracks 66 which are supported from bands (not shown) which extend around the entire inside periphery of the

refrigerator, each band being located between two drawers. The band beneath the lower drawer 24 can be omitted and the tracks 66 attached to the bottom 70 of the refrigerator, if desired. The rear portion of each of the tracks 66 is inclined downwardly and rearwardly to provide a gravity operated drawer closure. Each of the drawer frames 61 supports one, two, three or more trays 71. The outer trays 71 in the drawer 24 preferably (see Fig. 1) have inclined support members 72 therein which are curved or otherwise bent to keep bottles from rolling and have means for supporting the bottoms of the bottles.

By leaving spaces between the drawers at the rear thereof, cold air from the evaporator can get into the back of the lower drawers without passing through the top drawer, although cold air can reach the middle drawers through the top one. The air circulates to the front of each drawer. By locating a single aperture 111 in the front of the bottom 83 of the top drawer (as in the drawer 21—see Fig. 2), the air is drawn to the front of the drawer where some slides down (cold air travels in a very similar manner to water) into the next lower drawer. The lower drawers (and also the upper one) can each have a single aperture or a plurality of smaller ones so that air can circulate to the drawers below. There is an astonishingly even distribution of cold in these drawers.

Reference will now be made to Figs. 2 and 5 wherein arrows are superimposed on the structure to show the cold air circulation. As will be seen from these figures, there is a circulation at the rear of the refrigerator including the space behind each of the drawers (due to the fact that the space at the rear is not obstructed to interfere with this circulation) which permits part of the cold air from the evaporator coils 33 to drop to the lower portion of the refrigerator and circulate sideways and upwards by difference of temperature—no fans or forced circulation being necessary. This circulation is shown by the arrows in Fig. 5 and will be designated for the purposes of identification the "rear circulation." It is closely analogous to the circulation taking place in the ordinary "box-type" refrigerator except that it is not obstructed as there are no shelves or stored articles to impede it. In addition, because of various factors (all of which supplement each other and some of which are more effective than others), there is a "front" circulation of air as shown schematically by the arrows in Fig. 2. The above-mentioned factors include the sloped connecting members 38 and 39, the deflecting members 40, the space between the drawers 21, 22, 23 and 24 which fact permits air from the "rear circulation" to also circulate within each drawer, and the apertures 111 in the drawers shown in Fig. 2. It might be considered that each drawer reaches into the "rear circulation" and takes some cold air for itself, but actually the cold air pushes its way into and the warm air is pushed or drawn out of each drawer by the rapid "rear circulation."

The invention is applicable to both gas and electric refrigerators. Due to the fact that the major portion, at least, of the bottom 83 of each drawer (or of a rack or tray carried by the drawer frame) is impervious and extends in substantially a horizontal direction, the circulation in each drawer is substantially a horizontal one. If mesh bottoms are used, while there may be cold air forced into each drawer, it is not carried to the front or circulated in a generally horizontal direction as thoroughly as in the case where a substantially impervious bottom member 83 or tray or rack is used.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A mechanical refrigerator comprising insulated walls forming an enclosure and including upper and lower portions, the upper portion of the refrigerator having a front surface which is set-back from and is substantially parallel to the front surface of the lower portion thereof, an evaporator in said upper portion, a table-top member above the lower portion and in front of the upper portion, and a plurality of drawers arranged one above another in said lower portion and opening from the front of the refrigerator, said drawers having a length such that when they are in the closed position there is an open space at the rear thereof in which space there is a relatively rapid circulation of cold air which flows in a current from the evaporator downwardly and then upwardly in the rear part of the lower portion, and at least one of said drawers under the top one having a member (such as the bottom of the drawer or a rack or tray carried by the drawer frame), a major portion, at least, of which is impervious, extending in a substantially horizontal direction from the front part of the lower portion of the refrigerator into the cold air current at the rear thereof by an amount sufficient to deflect

cold air from said current toward the front part of said lower portion of the refrigerator but not sufficient to cut off said current, whereby there is produced a generally horizontal, slower moving air current in said drawer member in addition to the cold air current in the rear part of said lower portion.

2. A refrigerator according to claim 1 wherein at least one substantially planar deflecting member located under the evaporator is provided for assisting the circulation of cold air through said drawers.

3. A refrigerator according to claim 1 wherein at least one drawer under the top one is longer than the top one.

4. A refrigerator according to claim 1 wherein at least one of the drawers above the bottom one has an aperture in the bottom portion thereof to permit cold air circulation to a lower drawer.

5. A refrigerator according to claim 4 wherein said aperture is located at the front of said drawer.

6. A refrigerator according to claim 1 wherein a plurality of deflecting members having turned-up portions thereon are provided for assisting the circulation of cold air through said drawers, said members also serving to guide water of defrosting away from said evaporator, and wherein there is also provided a gutter member to receive the drip water from said turned-up portions and a tray to receive the water from the gutter member.

7. A refrigerator according to claim 1 wherein each of said drawers has a horizontal member, a major portion, at least of which is impervious, extending from the front part of the lower portion into said cold air current by an amount sufficient to deflect cold air from said current toward the front part of said lower portion of said refrigerator but not sufficient to cut off said current, whereby there is produced a generally horizontal air current above each of said horizontal members in addition to the cold air current in the rear part of said lower portion.

8. A refrigerator constructed and arranged substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 12th day of February, 1941.

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London, W.C.2.

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[This Drawing is a reproduction of the Original on a reduced scale.]

FIG. 1

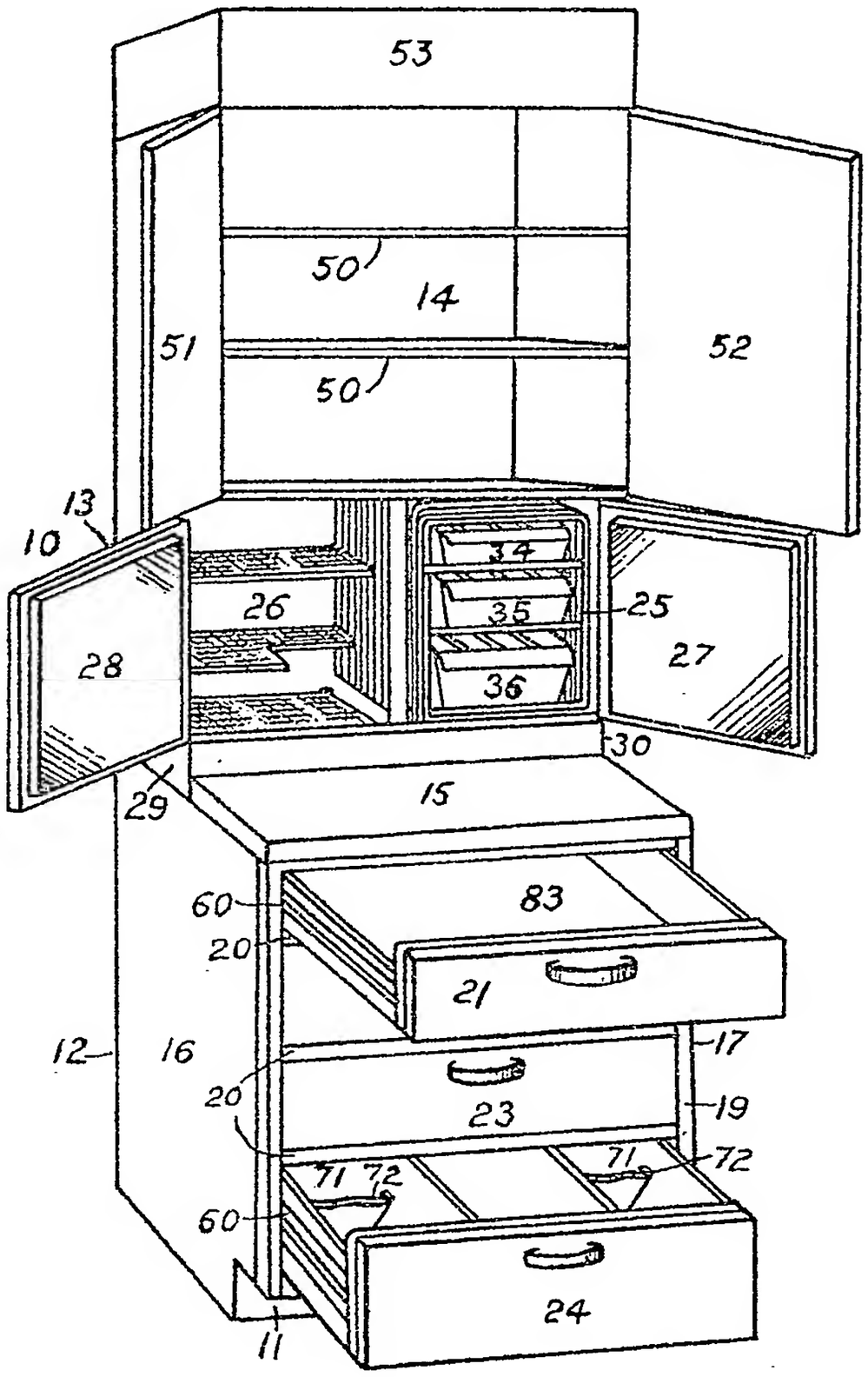


FIG. 3

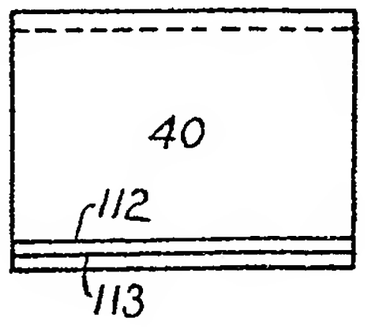


FIG. 2

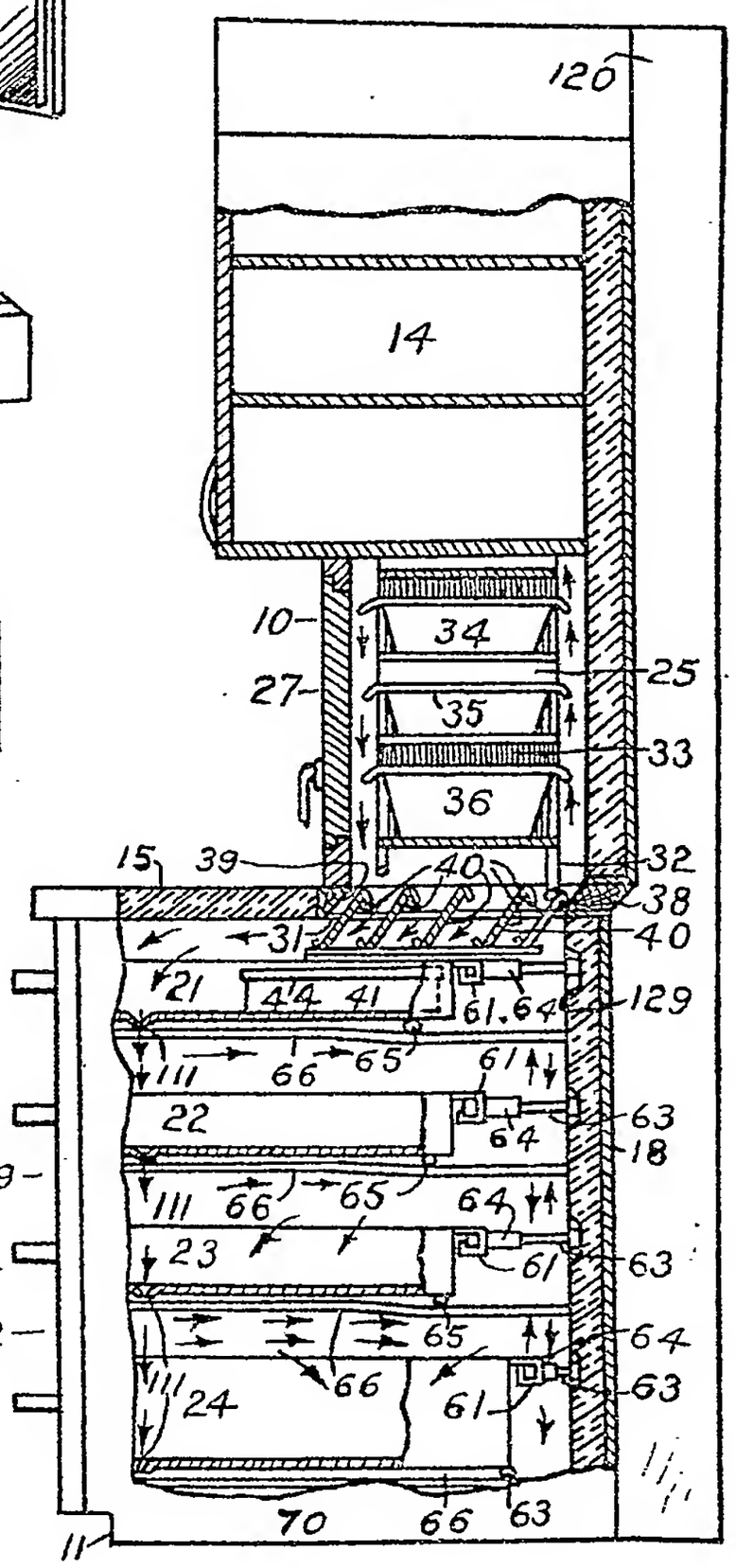
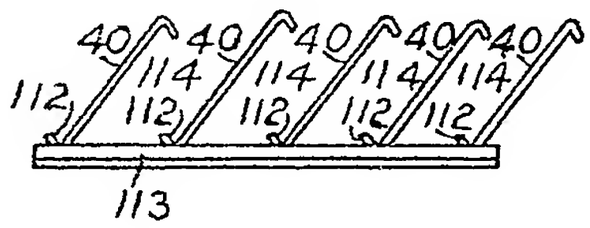


FIG. 4



2 SHEETS

SHEET 1

SHEET 2

FIG. 3

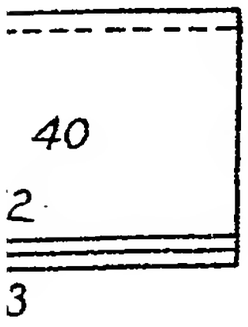


FIG. 2

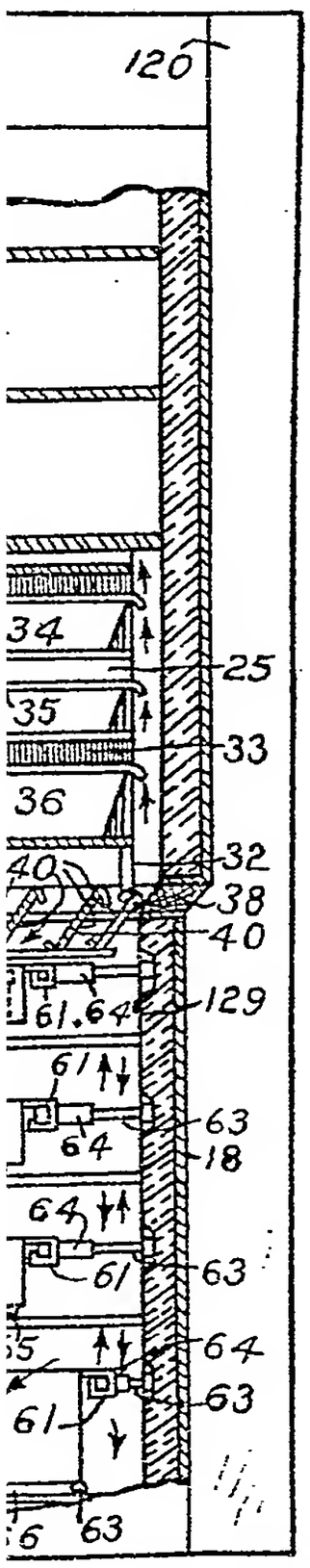
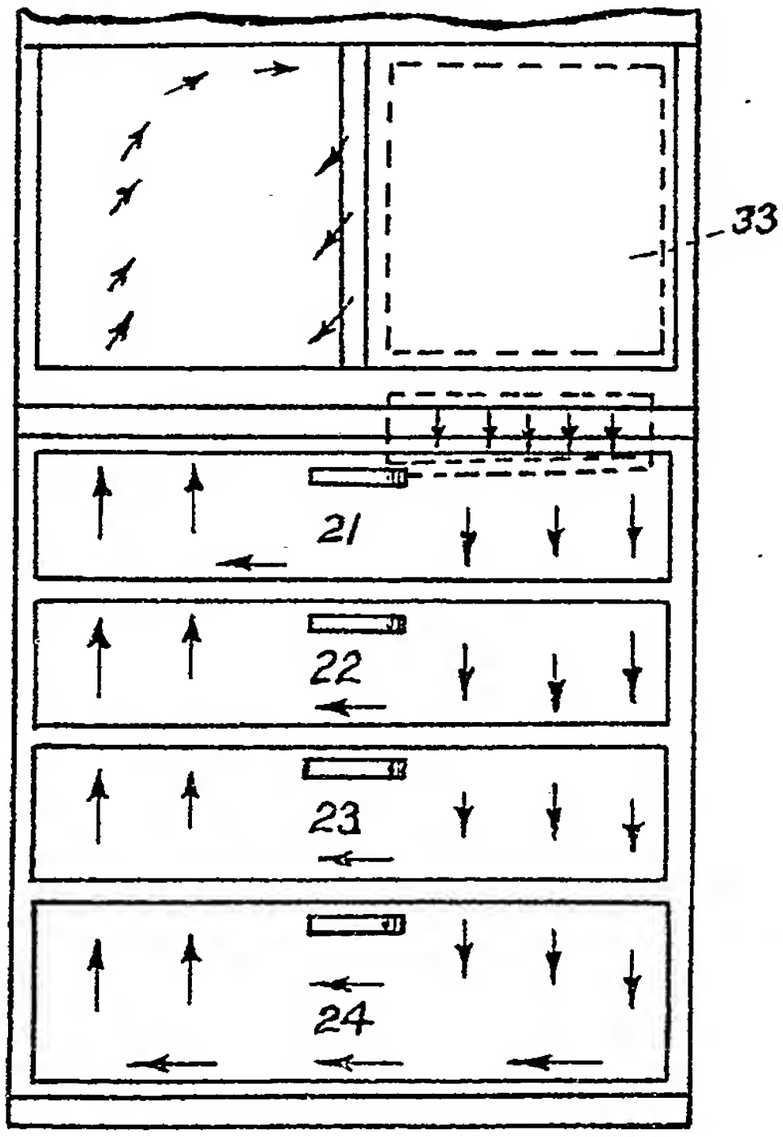


FIG. 5.



H.M.S.O.(Ty.P.)

581,121 COMPLETE SPECIFICATION

2 SHEETS

SHEET 1

SHEET 2

FIG. 1

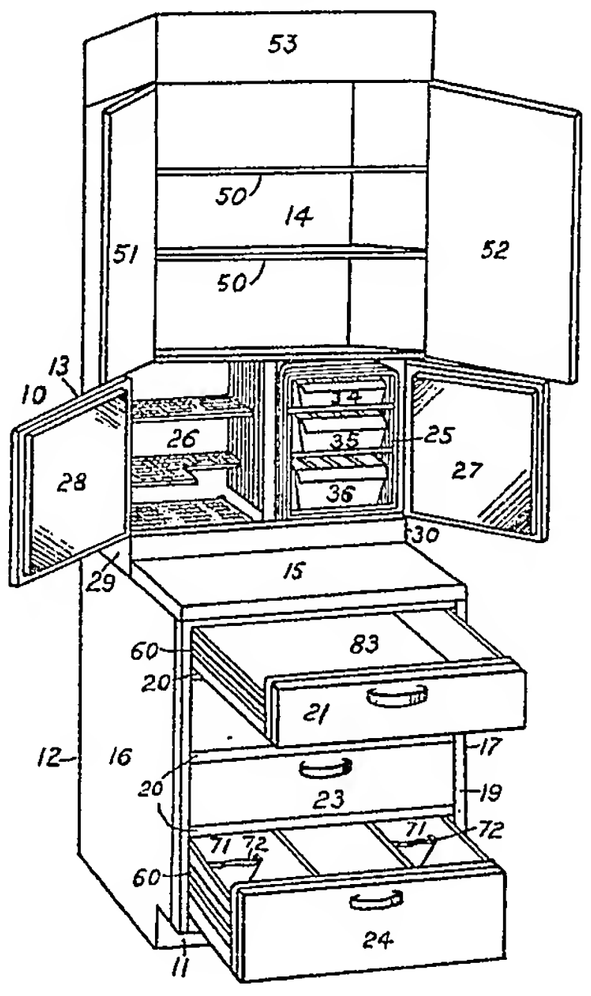


FIG. 3

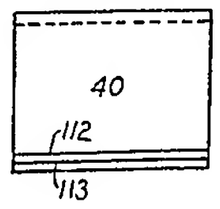


FIG. 2

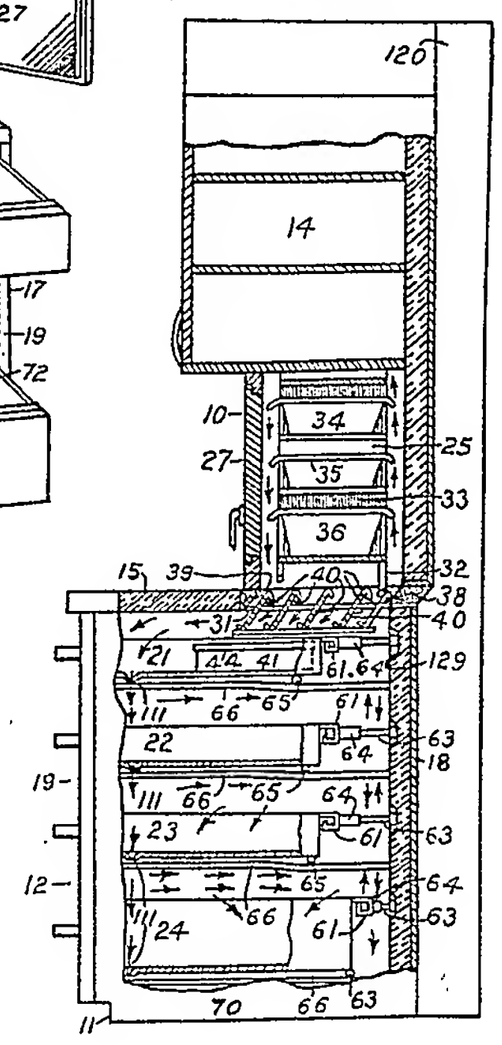


FIG. 4

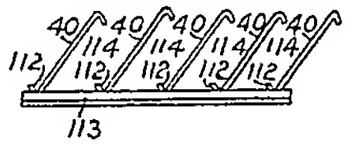
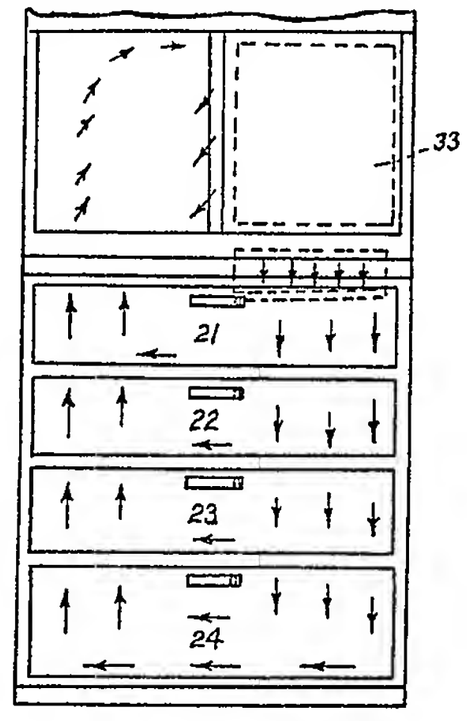


FIG. 5.



H.M.S.O. (Ty P)